

PRINTER RUSH
(PTO ASSISTANCE)

Application : <u>10/062116</u>	Examiner : <u>KUMAR</u>	GAU : <u>2631</u>
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DOC CODE	DOC DATE	MISCELLANEOUS
<input type="checkbox"/> 1449	_____	<input checked="" type="checkbox"/> Continuing Data
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[RUSH] MESSAGE: Please verify if there should be a provisional application. Its on the bib sheet, but not in the spec.

THANK you

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REV 10/04

**Frequency Offset Estimation for Communication Systems Method and Device
for Inter Symbol Interference**

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This application claims benefit to provisional application
s 60312618 Filed Aug. 15, 2001.

Field of the Invention

The present invention relates to frequency offset estimations for use in communications systems, and particularly to a frequency offset estimation based on state-based differential accumulation.

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BACKGROUND OF THE INVENTION

Many modern communication systems are carrier-modulated systems that transmit information bearing signals through some specified bands. Due to the mismatch between the local oscillators of the transmitter and the receiver, a carrier frequency offset is seen at the receiver. In general, a large frequency offset causes rapid phase rotation, which could be far beyond the tracking capability of the receiver functions, such as the carrier phase tracking loop and the channel estimator. It is thus desired to have an initial frequency offset estimation to reduce the amount of frequency offset seen by the remaining part of the receiver. Some current frequency offset estimation algorithms are based on the ideal channel condition of additive white Gaussian noise (AWGN) and in some applications, a communications channel experiences severe inter-symbol interference (ISI). One example is the multi-path fading channel for wireless communications where ISI leads to extra noise terms and degrades the performance of prior art frequency offset estimations.

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Several prior art frequency offset estimation schemes used in the ISI channels are briefly described herein. A "Fourier Coefficients after Non-linear Operation"